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TO THE
C. OF
ARATUS.

DISSECTORS AND DISINTEGRATORS.

MASHING.

1. DRAWING & TIME

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1881 E

FIG. 2.

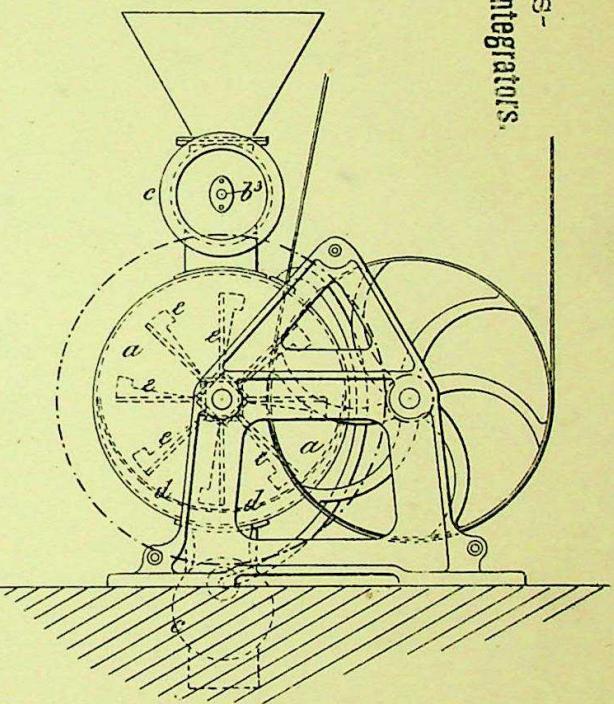


FIG. 4.

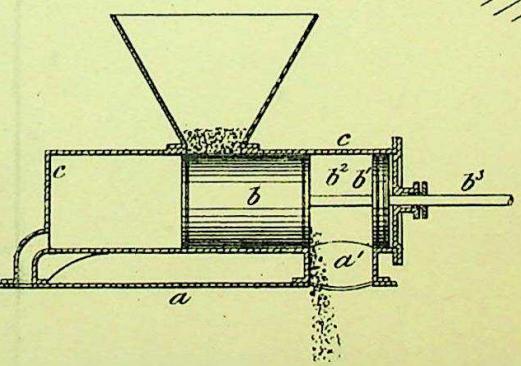


FIG. 1.

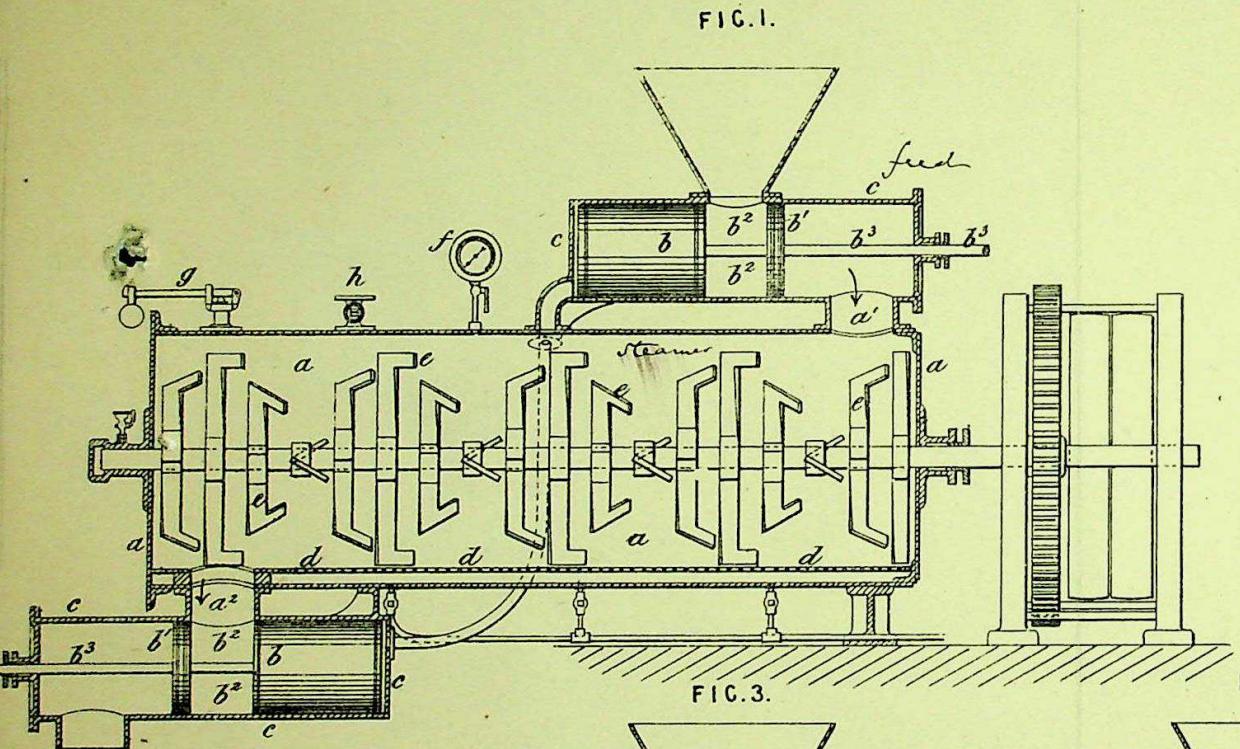
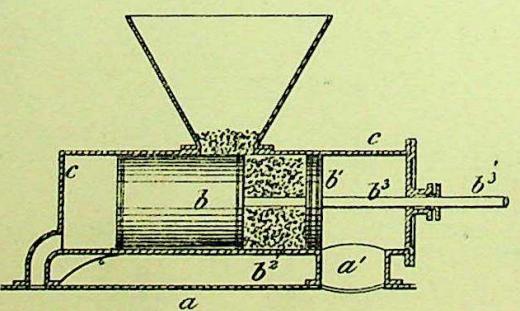


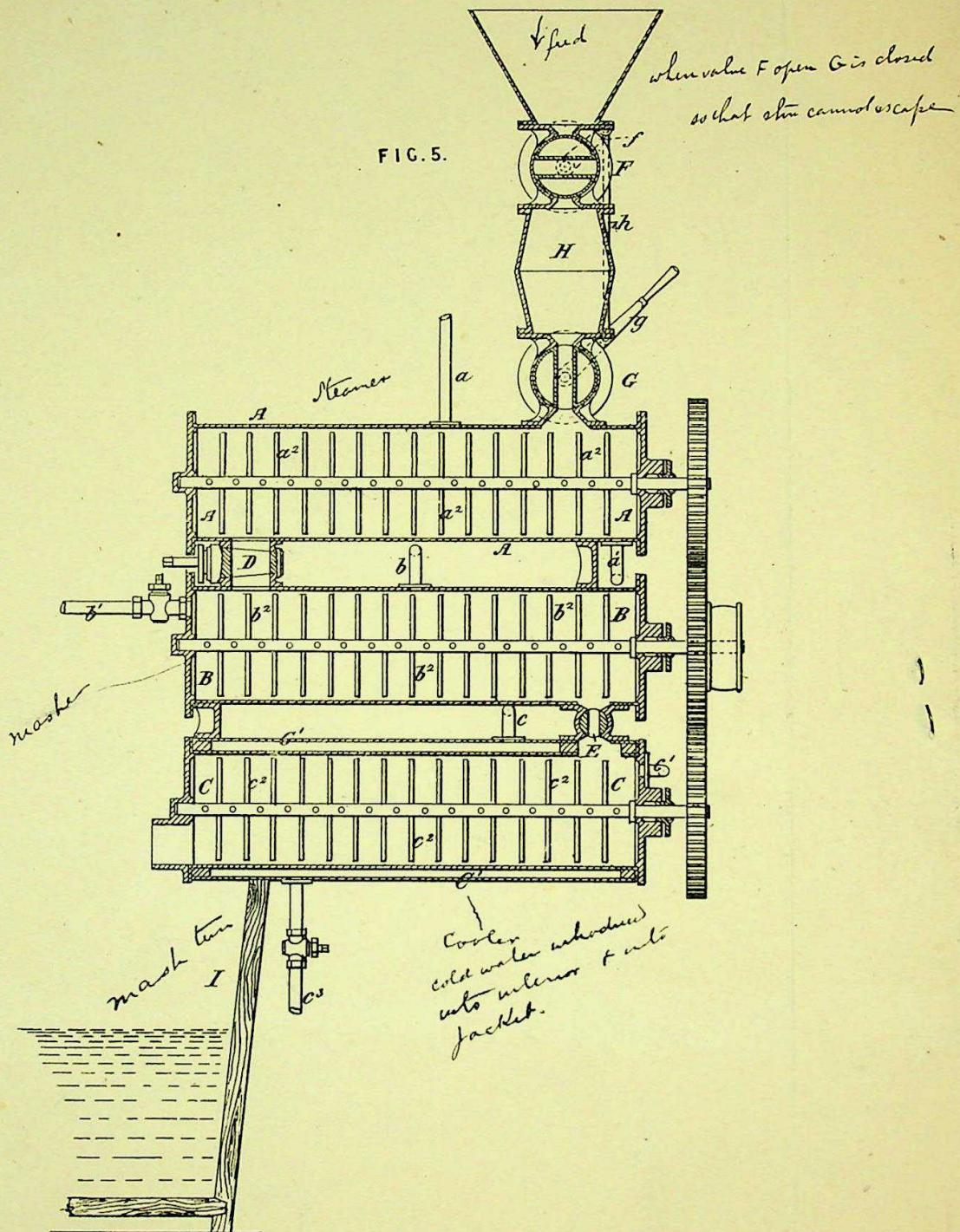
FIG. 3.



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FIG. 5.



Digesters and Distillers.

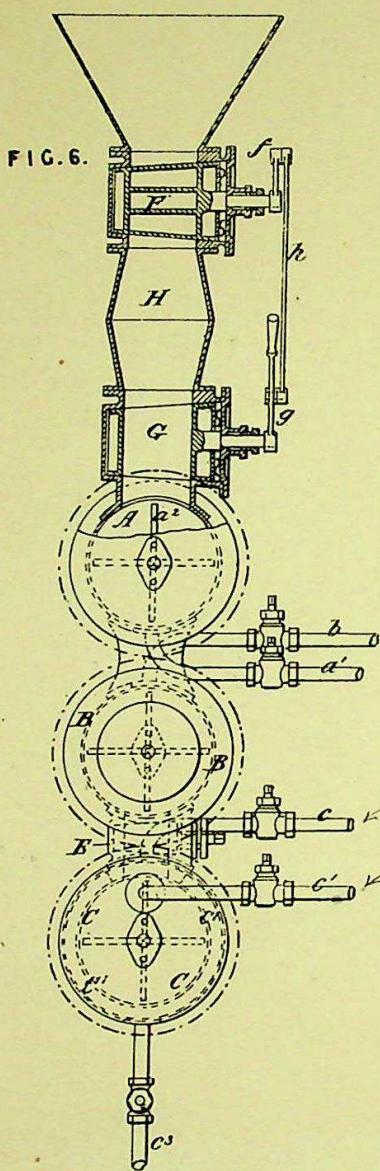
Apparatus

98. ALCOHOL
-Mashing.

95. ALCOHOL.

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1881



7. BREWING & FERMENTING

MASHING.

SHEET 1
AD 1881 JAN 26. N° 344.
GILLMAN & SPENCER'S SPECIFIC

(2) Sheet 2

Digesters and Disintegrators:
Apparatus:-
Digestors and Disintegrators:

195. ALCOHOL,
Technic:-

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1881
Digesters and Disintegrators.

Mailby & Sons, Photo-Litho.

ALCOHOL.

Mashing.

ALCOHOL.

344

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BEVERAGES

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RECORDED

A.D. 1881, 26th JANUARY. N° 344.

Apparatus for Treatment of Grain, &c.

LETTERS PATENT to Alexander William Gillman and Samuel Spencer, both of the Castle Brewery, Saint George's Road, Southwark, in the County of Surrey, for an Invention of "IMPROVEMENTS IN THE TREATMENT OF GRAIN OR CEREALS TO BE USED IN BREWING, DISTILLING, AND VINEGAR MAKING, AND IN MEANS OR APPARATUS EMPLOYED THEREIN."

PROVISIONAL SPECIFICATION left by the said Alexander William Gillman and Samuel Spencer at the Office of the Commissioners of Patents on the 26th January 1881.

ALEXANDER WILLIAM GILLMAN and SAMUEL SPENCER, both of the Castle 5 Brewery, Saint George's Road, Southwark, in the County of Surrey. "IMPROVEMENTS IN THE TREATMENT OF GRAIN OR CEREALS TO BE USED IN BREWING, DISTILLING, AND VINEGAR MAKING, AND IN MEANS OR APPARATUS EMPLOYED THEREIN."

The Invention consists of improvements in the treatment of grain or cereals to 10 be used in brewing, distilling, and vinegar making, and in means or apparatus employed therein.

For this purpose we take raw grain, either whole or crushed, and place it in a vessel capable, when closed, of sustaining a considerable steam pressure.

In this vessel we submit the grain to the action of steam under pressure for 15 sufficient time to gelatinize or rupture the starch granules, and convert them more or less into dextrine and sugar, and at the same time alter the condition of the albumenoids contained in the grain, thereby rendering the constituents of the grain partly soluble in water, and suitable to be afterwards treated with diastase or malt extract at convenient temperatures for its complete conversion. The pressure of 20 steam and consequent temperature is regulated according to the nature of the different kinds of grain and the amount of gelatinization or conversion desired to be produced.

By these means the grain is not reduced to a soft pulpy condition as when boiling the same in a quantity of water, but the steam and heat produce the

[Price 6d.]

Gillman & Spencer's Improvements in Apparatus for the Treatment of Grain, &c.

desired effect, somewhat swelling the grain, but do not impart an unnecessary quantity of moisture thereto.

The air is previously driven out of the steaming chamber, thereby preventing oxidation and acidity at the high temperatures employed.

After crushed grain has been thus treated it may be passed into a mashing tun 5 or vessel, and be mashed in the ordinary way, or in combination with barley malt or other malt; or the whole or crushed grain, treated as above described, may be dried on an ordinary kiln or other suitable apparatus to enable it to be preserved for future use when it is ground or crushed previous to use.

If desired the raw crushed or whole grain may, previous to being treated as above 10 described, be first soaked in water, or in a weak alkaline solution, in order to soften the grain and facilitate the action of the steam thereon, previous to which the surplus water is drained off therefrom.

The vessel in which the steaming process is effected is provided with a perforated or wirework inner cylinder or false bottom, and with rotating blades or stirrers, 15 and with a pressure gauge, safety valve, and blow off cock, the latter of which is used when required to enable the oils to be driven off from the grain, and such vessel may also be provided with a steam jacket to enable the same to be used for the drying process, in which latter case the steam would be shut off from the interior of the said vessel, and the fans or the vessel caused to rotate, in which 20 latter case the vessel would be provided with suitable blades or projections in the interior thereof to separate and agitate the grain, and thereby facilitate the drying thereof; or such arrangements may be applied to a separate drying vessel.

After being treated as above described the grain may be roasted in the ordinary way of roasting malt to produce a material in substitution for brown, or black, or 25 roasted malt for colouring stout and porter.

Or the crushed raw grain, either dry or previously soaked in water, or in a weak alkaline solution, and then drained, may be fed to an apparatus consisting of two or three chambers. In the first of these chambers the steaming operation, as above described, is performed; in the second the mashing takes place with boiling or hot 30 water, and when a third is used it is provided with cold water supply to act within a jacket; or cold water may be added to the mash in order to cool it.

Suitable valves control the flow of the material from one of the said chambers to another, and any one or all of the said chambers may be fitted with an agitator or stirrer.

The said apparatus is provided with pipes for the supply of hot water thereto for mashing, and steam to enable the mashing operation to be conducted under pressure; and in order to enable the said apparatus to be readily fed with the grain to be treated it is provided with a feeding arrangement consisting of two valves separated from each other by a convenient space. In charging the apparatus 40 the grain is introduced through the upper valve, the lower one being closed at such time, then the upper valve is closed, and the lower one opened, when the charge will freely descend into the apparatus. The two valves are so connected together that the one cannot be opened until the other is closed, thereby preventing the rush of steam therethrough.

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Gillman & Spencer's Improvements in Apparatus for the Treatment of Grain, &c.

SPECIFICATION in pursuance of the conditions of the Letters Patent filed by the said Alexander William Gillman and Samuel Spencer in the Great Seal Patent Office on the 26th July 1881.

ALEXANDER WILLIAM GILLMAN and SAMUEL SPENCER, both of the Castle 5 Brewery, Saint George's Road, Southwark, in the County of Surrey. "IMPROVEMENTS IN THE TREATMENT OF GRAIN OR CEREALS TO BE USED IN BREWING, DISTILLING, AND VINEGAR MAKING, AND IN MEANS OR APPARATUS EMPLOYED THEREIN."

The Invention consists of improvements in the treatment of grain or cereals to 10 be used in brewing, distilling, and vinegar making, whereby the expense and waste incurred in the process of making are avoided, whilst by our process we gelatinize or rupture the starch granules contained in the grain and convert them, more or less, into dextrose and sugar, and at the same time alter the condition of the albuminoids contained in the grain, thereby rendering the constituents of the grain 15 partly soluble in water and suitable to be afterwards heated with diastase or malt extract at the proper temperatures for its complete conversion.

For the above purpose we first soak the raw, crushed, or whole grain either in pure water or in water containing a small proportion of alkali, in order to soften the grain and facilitate the action of steam thereon in the subsequent process.

20 When steeping the grain in a weak alkaline solution, we prefer to employ a solution containing one and a half to two per cent. of any suitable alkali, preferring soda or potash, which may be used at ordinary atmospheric temperatures.

After the grain has been soaked a sufficient time in water or in a slightly alkaline 25 solution, the surplus water or solution should then be drained off therefrom, and if an alkaline solution has been used the alkali should be removed from the grain by washing the latter in pure water.

We find when soaking grain in pure water, and when treating whole barley the latter should be kept immersed for from about 40 to 50 hours, but when treating crushed barley an immersion of about from 1 to 3 hours will be found sufficient.

30 When soaking whole maize or Indian corn in pure water, we find it should be kept immersed for from about 15 to 20 hours, but when treating crushed maize or Indian corn an immersion of about 2 to 4 hours will be found sufficient.

When soaking whole rice in pure water we find it should be kept immersed for from about 2 to 3 hours, but when treating crushed or broken rice, an immersion of 35 from 1 to 2 hours will be found sufficient.

When soaking grain in a slightly alkaline solution, we find the following periods of immersion sufficient:—

For whole barley about 20 to 25 hours.

For crushed barley about $\frac{1}{2}$ to 1 hour.

40 For whole maize or Indian corn about 10 to 12 hours.

For crushed maize or Indian corn about $\frac{1}{2}$ to 1 hour.

For whole rice about 1 hour.

For crushed rice about $\frac{1}{2}$ to 1 hour.

In the event of treating other descriptions of grain, the time of soaking must be 45 varied according to the description and character of the grain used, and the length of time for soaking crushed or broken grain will vary according to the size of the particles.

After the whole or crushed grain has been sufficiently soaked, and the surplus water has been drained off therefrom, the moist grain is placed in a vessel capable 50 when closed of sustaining a considerable steam pressure.

In this vessel we submit the grain to the action of steam under pressure for sufficient time to effect the above mentioned change in the constituents of the grain.

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The pressure of steam and consequent temperature is regulated according to the nature of the different kinds of grain and the amount of gelatinization or conversion desired to be produced.

For grain soaked as above described we find the following pressures and periods during which such pressures are maintained produce the desired conversion. 5

For whole barley a pressure of about 10 to 15 pounds to the square inch, maintained for about 10 to 15 minutes.

For crushed barley a pressure of about 5 to 10 pounds to the square inch, maintained for about 5 to 10 minutes.

For whole maize or Indian corn a pressure of about 25 pounds to the square 10 inch, maintained for about 5 to 10 minutes.

For crushed maize or Indian corn a pressure of about 20 pounds to the square inch maintained for about 3 to 5 minutes.

For whole rice a pressure of about 20 pounds to the square inch maintained for about 2 to 3 minutes. 15

For crushed rice a pressure of about 20 pounds to the square inch maintained for about 1 to 2 minutes.

If a further conversion of the starch granules into dextrine and sugar than that produced by the above process be desired the grain must be submitted to higher pressures and for longer periods than those above indicated. 20

By these means the grain is not reduced to a soft pulpy condition, as when boiling the same in a quantity of water under steam pressure, but the steam and temperature produce the desired effect, somewhat swelling the grain, but do not impart an unnecessary quantity of moisture thereto.

If desired the previous soaking of the grain in water or in an alkaline solution 25 may be dispensed with, in which case it must be submitted for longer periods than those above mentioned to the action of steam under pressure, so as to cause the latter first to swell and then to effect the desired change.

We find that dry whole barley should be submitted to the action of steam at 10 to 15 pounds pressure to the square inch for a period of about 30 to 40 minutes, 30 whilst dry crushed barley would require to be so treated under the same pressure for about 20 to 30 minutes.

Dry whole maize or Indian corn should be submitted to the action of steam at 20 pounds pressure to the square inch for a period of about 30 to 40 minutes, whilst dry crushed maize or Indian corn would require to be so treated for about 20 to 30 35 minutes.

Dry whole rice should be submitted to the action of steam at 20 pounds pressure to the square inch for a period of about 15 to 20 minutes, whilst dry crushed rice would require to be so treated for 10 to 15 minutes.

It will be evident that the pressure of the steam and the length of time to which 40 the grain is submitted to its action may be somewhat varied, but in such case if the pressure of the steam be reduced the length of time should be proportionately increased, and *vise versa*.

Previous to operating on the grain in the steaming vessel or chamber the air is driven out of the latter, thereby preventing oxidation and acidity at the high 45 temperatures employed.

After crushed grain has been thus treated it may be passed direct into a mashing tun or vessel, and be mashed alone or in combination with barley malt or other malt in the manner ordinarily adopted in mashing malt. Or the whole or crushed grain treated as above described may be dried on an ordinary malt kiln, or in or 50 on other suitable drying apparatus, to enable it to be preserved for future use, after which when whole grain has been treated it is crushed or ground, and when crushed grain has been treated it is further crushed or ground, as may be required, previous to use.

Figure 1 is a longitudinal section, and Figure 2 is an end view of apparatus 55 employed in carrying out the treatment above described, and Figures 3 and 4 are sectional views of the feeding apparatus in different positions.

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The vessel *a* in which the grain is steamed is of cylindrical form, and is provided with suitable openings *a¹*, *a²*, for admission and discharge of its contents, and such openings are capable of being opened or closed when desired by valves or otherwise, as will be well understood. The apparatus we prefer to employ for feeding and discharging the contents of the cylinder *a* consists of two piston or other valves *b*, *b¹*, separated from each other by a convenient space *b²*, steam from the cylinder *a* being admitted to the cylinders *c* so as to act on the backs of the piston valves *b*, *b¹*, to equalise the pressure thereon, and thereby to facilitate the action thereof.

Motion is given to such piston valves *b*, *b¹*, by any suitable apparatus arranged 10 to act on the piston rods *b³*. By these means the chamber *a* can be fed and the contents thereof discharged without the steam being permitted to rush out of the feed and discharge openings *a¹*, *a²*.

The said vessel *a* is also provided with a perforated or wire work inner cylinder or false bottom *d*, and with rotating blades or stirrers *e*, and with a pressure 15 gauge *f*, safety valve *g*, and blow off cock *h*, the latter of which is used when treating certain classes of grain to enable the oils (which would, if retained, impart injurious flavours to the product) to be driven off from the grain, and such vessel may also be provided with a steam jacket (not shown) to enable the same to be used for the drying process, in which latter case the steam would be shut off 20 from the interior of the said vessel and the fans caused to rotate in order to separate and agitate the grain and thereby facilitate the drying thereof; or a separate drying vessel may be used, in which case it may be constructed and operated as above described; or it may be mounted on axes and caused to rotate, in which latter case the vessel would be provided with suitable apertures and covers for supply and 25 discharge, and with blades or projections fixed to the interior surface thereof to separate and agitate the grain, and thereby facilitate the drying thereof. Suitable means may also be adopted for withdrawing the moisture from the interior of the drying apparatus, or such moisture may be merely allowed to escape through suitable openings provided for the purpose, as will be well understood.

30 After being treated as above described the grain may be roasted in the ordinary way of roasting malt to produce a material in substitution for brown, or black, or roasted malt for colouring stout and porter.

Instead however of drying the grain after steaming it as above described, the crushed raw grain, either dry or previously soaked in water or in a weak alkaline 35 solution and then drained, may be fed to an apparatus consisting of two or more chambers, as represented in the accompanying Drawings, of which Figure 5 represents a longitudinal section and Figure 6 an end view partly in section.

In the chamber A the steaming operation as above described is performed. In chamber B the mashing takes place with boiling or hot water, and when a third, C, 40 is used it is provided with cold water supply to act within a jacket C¹, or cold water may be added to the mash in order to cool it. *a* represents a pipe connected with chamber A to supply the same with hot water, and *a¹* another pipe connected to such chamber A to supply steam thereto; *b* and *b¹* represent respectively steam and hot water supply pipes connected with the chamber B to enable the mashing 45 operation to be conducted under steam pressure, and *c*, *c¹*, represent respectively pipes for conveying cold water to jacket C¹ and cold water to the interior of the chamber C, and *c²* represents a pipe for conveying the water from the jacket. A cock or valve D controls the flow of the material from the chamber A to the chamber B, and a cock or valve E controls the flow of material from the chamber B 50 to the chamber C.

The chambers A, B, C, are represented as being all provided with stirrers or agitators *a²*, *b²*, *c²*.

In order to enable the said apparatus to be readily fed with the grain or cereals to be treated it is provided with a feeding arrangement, consisting of two cocks or 55 valves F, G, separated from each other by a convenient space H. The cocks or valves F, G, are connected together by levers *f*, *g*, and a link *h*, or by other suitable

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means, so that the one cannot be opened until the other is closed, thereby preventing the rush of steam therethrough.

In charging the apparatus the grain or cereals are introduced through the upper valve F, the lower one G being closed at such time, then the upper cock or valve F is closed and the lower one G opened, when the charge will freely descend into the 5 chamber A. Other arrangements of valves may however be employed so long as they act in manner above described.

The cooled mash will flow out of the chamber C by the opening C² into the mash tun I. The stirrers or agitators a², b², c², may be rotated as shown or in any other convenient manner. 10

Having thus described the nature of our said Invention and the mode in which we carry the same into effect, we would have it understood that what we claim is,—

First. Submitting crushed or whole grain, either previously soaked in water or in a weak alkaline solution, or in a dry state, to steam under pressure, and for 15 about the periods mentioned, after which the grain so treated is passed direct to the mash tun, or it is dried for future use and crushed or ground, all substantially as herein described and for the purpose stated.

Second. Treating grain in order to produce a substitute for brown, black, or roasted malt, substantially as herein described and for the purpose stated. 20

Third. The novel combination and arrangement of machinery or apparatus for steaming whole or crushed grain, substantially as herein shown and described with respect to Figures 1, 2, 3, and 4, and for the purpose stated.

Fourth. The novel combination and arrangement of machinery or apparatus, substantially as herein shown and described with respect to Figures 5 and 6, and 25 for the purpose stated.

In witness whereof, we, the said Alexander William Gillman and Samuel Spencer, have hereunto set our hands and seals, this Twenty sixth day of July, in the year of our Lord One thousand eight hundred and eighty one.

ALEX. W. GILLMAN. (L.S.) 30
SAML. SPENCER. (L.S.)

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For Her Majesty's Stationery Office.

1881.